Vol. 1—5

PAVING AND MUNICIPAL ENGINEERING.

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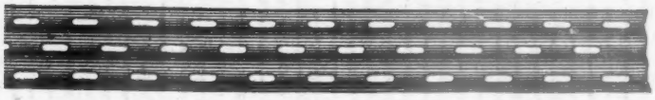

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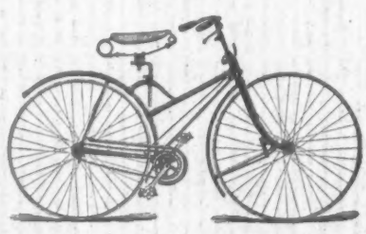

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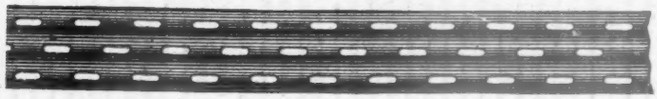

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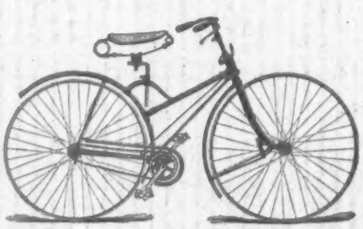

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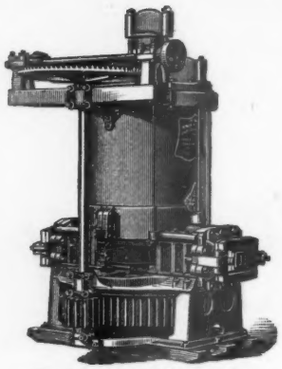

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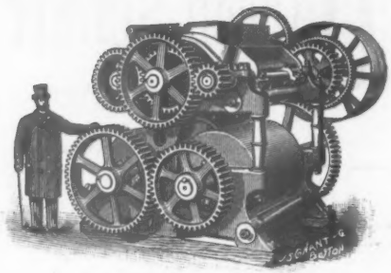

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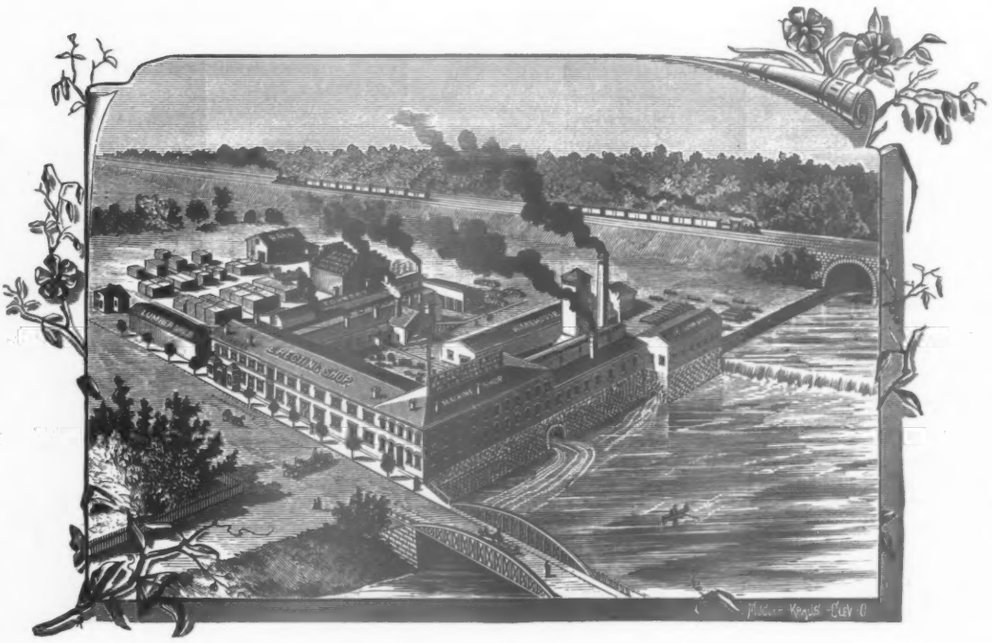

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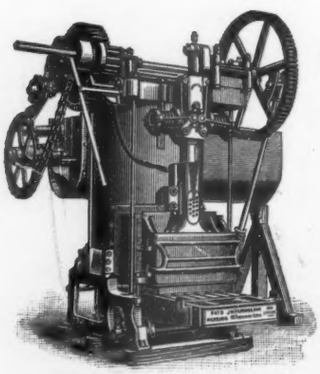

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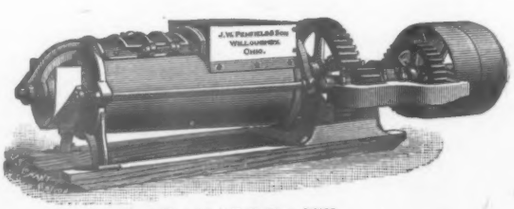

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VOL. 1. INDIANAPOLIS, IND., OCTOBER, 1890. No. 5.

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THE PAVING PROBLEM.

By James W. Howard, C. E.

IN Westminster Abbey, where England seeks to bury those whom she highly honors, lie side by side, near the center of the Nave, two men, whose useful lives brought to the world many lasting benefits. The inscriptions are, "Thomas Telford, 1834," and "Robert Stephenson, 1859." One was the greatest road builder England ever had, whose name is perpetuated by the Telford roads which lie like a network all over the land. The other was the man whose engines, now perfected, complete the intercommunication of knowledge, commerce and prosperity which well paved and well maintained roadways had inaugurated.

Thomas Telford showed that road-making and road-maintaining require diligent, constant and careful study.

The comfort, wealth, character and success of a community, large, or small, depend upon the condition of its avenues of communication with the outside world and within itself.

Well paved, well maintained and well cleaned streets are to our cities what well floored, well repaired and well swept hallways are to our buildings and to our houses. A *city* is the home of its inhabitants—the citizens; just as the *house* is the home of its inhabitants—the family. Both are used by all. Both deserve careful attention.

Great delay has occurred in the improvement of our pavements, because we have too long employed that most expensive and the hardest of masters, namely, "our own experience."

Travel, observation and the need of economy, due to competition with other cities, convince us that many cities are better equipped than we, and at a less ultimate expense besides. We finally heed the German adage, "*Sehe alles, behalted as beste*"—examine all, retain the best.

What if we do look abroad for one thing better than at home? Have we not many superior things of our own of which we can be justly proud? For many years carefully tabulated records have been kept in France, England and Germany. These are at our disposal. Any one can consult them. We can, and do, use their experience and reap rich results.

Great improvements have been made in lighting and draining our streets. But the questions of paving, maintenance and cleaning have, in most cities, too often been left to inefficient men. Many of the so-called pavers and local contractors have seldom seen more than the work of their own or immediate neighborhood. Nor can more be expected of many of them. Travel is needed. This requires leisure which they seldom have.

Special training, moreover, is needed to investigate, sift, tabulate and act upon the experience of others. If one or two foreign languages are needed, the investigation becomes still more difficult.

Paving has been regarded by many, who should know better, as out of the province of engineering. So were waterworks, so were sewers, so were many branches of public work, until, after long struggle, much patience, strong opposition and costly experience, city after city has taken these things out of the hands of the simply practical, and entrusted them to men both practical, scientific and economical.

Nothing encourages this work of improvement more than the fact that a Board of Trade of a city takes up the problems involved, and studies how to make the surroundings more agreeable and business more profitable; how to increase the earning power of the city; how to remove the costly embargo on business caused by poor pavements; how to relieve the cost of horses needed to move heavy loads, the cost of constant repairs to pavements, vehicles and harness, the cost of street cleaning, the cost of excessive sprinkling. In fine, the study of the health and progress of a community means to discover how much depends upon pavements.

Nothing is more essential to a city than efficient streets.

The existence in France of its "*Ecole des Ponts et Chaussees*"—School of Bridges and Roads—has supplied that country with roads as smooth as race tracks to every corner of the land, and its cities with pavements like floors.

Next to railways and real estate, the streets of the cities absorb the most money expended upon any one object. *Pavements must be had.* A city without pavements could not preserve its economical existence.

There are three periods in the history of the paving of a city:

First.—Ignorance and apathy.

Second.—Empiricism or rule of thumb combined with conservatism or rule of habit.

Third.—The application of scientific means and methods.

From a scientific standpoint, the paving problem presents itself thus: *Firstly.*—Shall we reduce the first cost and neglect subsequent expenses? or, *Secondly.*—Shall we seek durability only and neglect maintenance, eventual renewals of the whole surface, cleaning and the indirect expenses to the public from the wear of vehicles and animals? or, *Thirdly.*—Shall the policy not rather be, to consider not only the first cost, but also the costs of maintenance, renewals, cleaning, sprinkling; and to give due regard to the private

expenses of citizens arising from the cost of traction, also to study the convenience, comfort and health of the people.

In order to compare the values of different pavements, we must have a standard with which all can be directly compared. The pavement which at first seems cheap is, in the end, most costly. This standard is best established by defining that which a theoretically ideal and perfect pavement would be.

A perfect pavement would provide a surface for the easy passage of vehicles, with the least traction consistent with foot-hold for animals. It would be easily cleaned, retain no filth, produce no odor nor dust, suppress jarring, not only of vehicles passing over it, but also of the subsoil and of the adjacent buildings. It would permit quick and easy repairs.

The question of cost is a relative one. Pavements must be had. We seek the maximum results and the minimum expenditures.

Remember the rule taught in the French School of Engineers, namely, "*Economical maintenance, and not cheap prime cost, is the truest economy for all public works.*" This is especially true of street paving. Yes, true economy considers not only the first outlay, but also the cost of repairs to pavement, vehicles, harness, wear on horses, weight of loads, the number of horses needed, the effect of frost, the dust which involves our clothing, furniture, comfort and health. We must, where possible, suppress the noise, and not forget to seek to eliminate the jarring which, on certain streets, slowly but surely injures buildings, and causes too often, under our streets, leaking of gas, water and other pipes.

The materials in modern use for paving are principally some forms of earth, gravel, Macadam, Telford-Macadam, cobble or boulder stone, wooden blocks, burned clay bricks, scoria or slag blocks, asphalt blocks, certain sandstone blocks, syenite blocks, granite blocks, and pavements of various asphalts and their imitations and adulterations with coal tar and other products.

However, the only materials which can practically attempt to fulfill the requirements of well traveled streets are *natural stone* of different kinds and forms, and *genuine asphalt* of different kinds, applied in several ways. Other materials all fail (except where special local reasons permit or compel their use) because of their roughness, weakness, cost of maintenance, or from the injury caused to vehicles or animals, or because of dirt, dampness or dust.

Artificial paving blocks, either of brick, slag, or asphalt (which is combined with crushed lime stone, etc.) may be used under very light traffic, but increased traffic causes frequent renewals which prove very expensive.

Wood pavements are practically of two kinds: cedar blocks, like cylinders on end, and blocks cut with parallelogram faces. Their cheap first cost has tempted several cities to try wood. *Chicago*, for one, has proven that in less than nine years it is cheaper to use sheet asphalt or even the best granite blocks on a proper foundation.

The best wooden block pavements are those of London, where every block has to be replaced, under moderate traffic once in six years, and under heavy traffic once in four years. The expense is enormous, far greater than for granite blocks. But the noise must be suppressed at almost any cost. Sheet asphalt, far cheaper in the end than wood, is steadily replacing the wood in the heart of London.

Our own experience in the United States has taught us to set aside wooden pavements.

A city which has established grades, assured business, constant traffic, must provide, in its different quarters, pavements of different kinds for either light, moderate or heavy traffic.

The material usually the easiest to be had is *stone*. It can be laid without foundation, in a crushed form called "Macadam." It can be laid in a crushed form upon a foundation of closely set large rough stones and called "Telford" or "Telford-Macadam." It can be hewn into blocks of several shapes, and used with or without a foundation. The best shape is the so-called "oblong block," which is a parallelopipedon.

The other material, extensively employed, is *asphalt*. This makes an excellent pavement, if, without adulteration, it is properly laid. Care must be taken to obtain a kind of asphalt pavement which has been successfully used under varying traffic, climate and condition. New and experimental asphalt pavements should not, as a rule, be tried at public expense.

[Mr. Howard's discussion of the paving problem will be continued in the next issue of Paving and Municipal Engineering.]

THE PAVEMENTS AND SEWERS OF LIVERPOOL.

By Thomas H. Sherman, U. S. Consul.

AFTER many years of experiment and the expenditure of vast sums of money in pavements the corporation of Liverpool now points with justifiable pride to its 250 miles of the best paved streets in the world.

The policy adopted by this corporation in the execution of public works in the best possible manner, and generally by their own workmen, has proved successful in every way; and, by a judicious capital expenditure, the cost of maintenance of the roads, sewers, and other public works is reduced to a minimum, and the greatest economy is thereby attained.

The laying of the impervious pavement which was adopted in 1872 for the carriage-ways of the city has been continued up to date, without intermission, and is still in progress, resulting in nearly 1,750,000 yards superficial of impervious carriage-way pavements and a saving by the execution of this class of work unprecedented in municipal experience.

The financial result can best be shown by the following: Dealing with the year 1879, under the present city engineer (Mr. Clement Dunscombe, M. A., M. Inst. C. E.), the estimated expenditure for the general repairs to the roads in the city was £28,000 ($136,080), the mileage of adopted roads at that time being 226 miles. Concurrently with the extension of the impervious carriage-way pavements, the expenditure under this head has been reduced year by year till the estimated cost for the current year (1889) is only £8,400 ($40,824), with a street mileage under repair of 254 miles. This reduction has not been effected, as might at first sight be supposed, by an increased rate under this head, due to an augmented capital expenditure requiring the provision of additional interest and sinking fund to redeem the original debt for paving and like works within the twenty-three years (from 1870, when the loan was effected, to 1893, when it will be paid), as the amount raised on paving rate account in the year 1879 was, approximately, £17,000 ($82,620) more than in the year 1889, although the interest and sinking fund on the debt had increased from about £13,000 ($63,180) per annum in the year 1879 to about £47,000 ($228,420) per annum in the year 1889.

Appended hereto are the specifications for paving first, second, and third class streets.

Pavement designated as first-class is usually laid down in the main streets of heavy traffic in the central parts of the city.

Permission is never given to private companies or persons to cut through the pavement in any street for any purpose. When such work is necessary, the corporation will do it in its own thorough way, and the interested parties must pay the entire cost—a regulation worth noting.

PAVING SPECIFICATIONS.

First-class streets.—Excavate or fill in the ground, as the case may be, to the requisite level, and remove all surplus material. Properly form and trim off the surface and thoroughly consolidate same, and then lay a foundation of not less than 6 inches of Portland cement concrete, corporation standard. The paving shall consist of granite or syenite sets, 3½ inches wide by 6½ inches deep, from North Wales or other approved quarries, laid in regular, straight, and properly bonded courses, with close joints, and to be evenly bedded on a layer of fine gravel half an inch in thickness. After the paving is laid the joints shall be filled with hard, clean, dry shingle; the sets shall then be thoroughly rammed and additional shingle added until the joints are perfectly full. The joints shall then be carefully grouted until completely filled with hot asphalt,

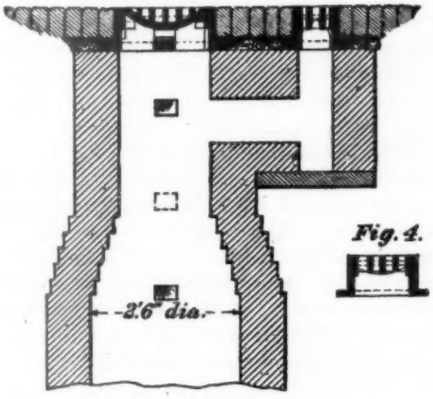
composed of coal pitch and creosote oil, and, finally, the paving is to be covered with half an inch of sharp gravel.

The crossings shall consist of three rows of 16-by-8-inch granite crossing stones, and the remaining space shall be paved on each side of the crossing stones to the full width of the foot-way, in a similar manner to the carriage-way. The crossing stones shall be of granite of a quality to be approved by the engineer, dressed perfectly true, and out of winding on the face; the sides and joints to be perfectly square and accurately dressed throughout their entire depth; the stones to be bedded on cement concrete, the joints to be filled with shingle and grouted with hot asphalt. A triangular groove an inch wide by three-fourths of an inch deep to be run along the upper surface of each stone. No stone to be less than 3 feet in length.

The footways shall be paved with Yorkshire or Lancashire flags of the best quality, not less than 3 inches thick. No flag to measure less than 2 feet in width or to be of less area than 6 feet; to be solid, free from laminations, the upper surface to be true and free from windings or hollows; the joints to be squared the whole thickness. The flags to be laid on a bed of fine gravel, with close, neat joints flushed in mortar, and in uniform courses breaking bond. The joints to be dressed after laying, where necessary.

The channel stones to be of granite or syenite, of a quality to be approved by the engineer, and to be not less than 3 feet in length.

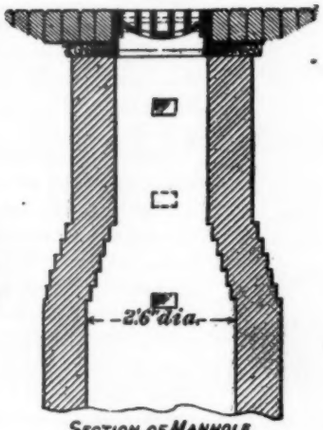
Fig. 1.



SECTION OF MANHOLE SHOWING SOLID COVER AND VENTILATING CHAMBER.

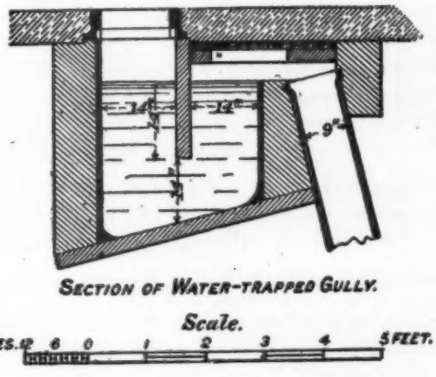
Fig. 4.

Fig. 2.



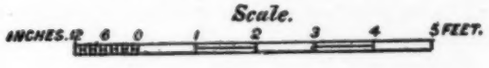
SECTION OF MANHOLE WITH VENTILATING COVER.

Fig. 3.



SECTION OF WATER-TRAPPED GULLY.

Scale.



DRAWING No. 1.

The upper surface, if not self-faced and perfectly true, must be accurately worked out of winding, the bed even and parallel to the face, the sides and ends truly square; the stones to be bedded on cement concrete, and the joints to be filled with clean shingle and grouted with hot asphalt.

The curb-stones to be granite or syenite, straight or circular as required, 6 inches thick at top, 7 inches thick at 5 inches below, and not less than that thickness for the remainder of the depth; to be not less than 12 inches deep nor less than 3 feet in length; to be carefully dressed on top, 8 inches down the face, and 3 inches down the back; the remainder of each stone to be hammer dressed; the heading joints to be neatly and accurately squared throughout the entire depth.

Second-class streets.—Excavate or fill in the ground, as the case may be, to the requisite level, and remove all surplus material; properly form and trim off the surface, and thoroughly consolidate the same, and then lay a foundation of (*a*) not less than 6 inches of Portland cement concrete, corporation standard, or (*b*) not less than 6 inches of bituminous concrete, consisting of clean and angular broken stone, grouted with hot asphalt composed of coal pitch and creosote oil, covered with chippings, and thoroughly consolidated by rolling with a roller of sufficient weight. The paving shall consist of granite or syenite sets 3 inches wide by 5 inches deep, or of granite or syenite 4-by-4-inch cubes from North Wales or other approved quarries, laid in regular, straight, and properly bonded courses, with close joints, and to be evenly bedded on a layer of fine gravel half an inch in thickness. After the paving is laid the joints shall be filled with clean, hard, dry shingle; the sets shall then be thoroughly rammed, and additional shingle added until the joints are perfectly full. The joints shall then be carefully grouted until completely filled with hot asphalt composed of coal pitch and creosote oil, and, finally, the paving shall be covered with half an inch of sharp gravel.

The crossings, footways, channels, and curbs shall be the same as specified for first-class streets.

Third-class streets.—Excavate or fill in the ground, as the case may be, to the requisite level, and remove all surplus material; properly form and trim off the surface and thoroughly consolidate the same, and then lay a foundation of hand-pitched rock 6 inches in depth, set on edge in the manner of a rough pavement. Over this a coating of gravel is to be laid of sufficient thickness to fill in the interstices and to form a smooth surface to the foundation, which must be thoroughly consolidated by rolling with a steam-roller before the paving is laid. The paving shall consist of 4-by-4-inch granite or syenite cubes from North Wales or other approved quarries, laid in regular, straight, and properly bonded courses, with close joints, and to be evenly bedded on a layer of fine gravel half an inch in thickness. After the paving is laid the joints shall be filled with clean, hard, dry shingle; the sets shall then be thoroughly rammed and additional shingle added until the joints are perfectly full. The joints shall then be carefully grouted, until completely filled up, with hot asphalt composed of coal pitch and creosote oil, and, finally, the paving shall be covered with half an inch of sharp gravel. The crossings, footways, channels, and curbs shall be the same as specified for first-class streets.

SEWERS.

During the past seventeen years Liverpool has expended for sewerage works approximately £350,000 ($1,703,000), and this outlay has been thoroughly reproductive from a sanitary point of view in a lessened mortality rate. Mr. Dunscombe, the city engineer, says in his annual report that prior to 1871 there were no ventilators fixed upon the main sewers in the city. At that date 1,046 Archimedean screw ventilators, 6 inches in diameter, were connected with the branch sewers from courts, the 6-inch pipe being attached to the side of one of the court houses wherever permission could be obtained. Of this number there are at the present time 976 remaining, which includes a few shaft ventilators added since 1871, mainly in confined situations where open grid ventilation was found to be objectionable, the demolition of insanitary court houses and of property for railway and other improvements having reduced the number that were originally fixed.*

* As regards the Archimedean screw ventilators, Doctors Parkes and Sanderson state, in their report, as their opinion that, notwithstanding the mechanical efficiency of the Archimedean screw ventilators, they exercise no practical influence in preventing the escape of sewer air into the streets and houses.

The cost of these ventilators, including fixing, is stated to be £10 each, and the annual cost of maintenance about 5s. each.

Ventilating grids or ventilating man-hole covers, as the case may be, the clear opening in each being not less than 63 square inches, have been fixed along the main sewers at a distance apart of 80 yards approximately.

Drawing No 1, figure 1, shows the arrangement adopted where the ventilating grating is fixed over a chamber constructed at the side of a man-hole.

Drawing No. 1, figure 2, shows a man-hole cover and ventilator combined.

Where the distance between the man-holes is more than the specified distance apart of 80 yards, ventilating grids, as shown in Drawing No. 1, figure 4, have been fixed on special shafts over the sewer, so that this uniform distance is maintained throughout.

Prior to 1876 detail records do not seem to have been kept in the engineer's department of the rate of progress of this work, but it appears that up to that year 28 miles of main sewers had been ventilated.

With the exception of those sewers into which hot water is discharged or steam injected, and which are few in number, the ventilation of the whole of the Liverpool main sewers was completed in 1882, embracing the following mileage, viz:

	Miles.
Up to 1876	28
1876	16
1877	18
1878	12
1879	41
1880	35
1881	25
1882	2
Length of sewers ventilated to year 1882	177
New sewers constructed and old sewers reconstructed from 1876 to 1885 inclusive	72
Total mileage of brick and pipe sewers ventilated to year 1885	249

All new sewers are now ventilated in a similar manner, as their construction proceeds.

The total cost of ventilation has been £12,000, or 7d per yard run of sewer.

The records of the progress of this work up to 1880 appear to be incomplete. Since that year all defective gullies have been altered, improved, or reconstructed practically in accordance with drawing No. 1, figure 3, and all new gullies have been built in accordance with this drawing.

This form of gully combines the essentials requisite to reduce to a minimum the quantity of detritus entering the sewers.

Up to date 5,219 gullies have been constructed or reconstructed.

No systematic cleansing of the sewers appears to have obtained prior to 1871, but from that year systematic cleansing of the main sewers in the lower districts of the city and tide-locked sewers has been carried out, in addition to the cleansing which takes place previous to the execution of repairs.

The necessity for cleansing the sewers which have been repaired and the gullies emptying into same rebuilt has been in a great measure obviated, owing to—

(1) The improved construction of the gullies, by which less detritus enters the sewers, the extension of impervious pavements of slow-wearing material, and the reduction in the area of macadamized roads.

(2) The generally self-cleansing condition of the sewers as repaired, and their systematic flushing.

The cost of this work for the parish is £1,302 per annum, and for the out-townships £1,736 per annum.

Preparatory to executing any repairs in a sewer it is thoroughly cleansed, and then inspected to ascertain what repairs are necessary, in order to put it into perfect condition and make it, in the future, as far as possible self-cleansing.

The repairs executed to the sewers are: (1) Repairs dependent upon the defective junction of branch sewers with main sewers, either in plan or section; (2) repairs required consequent upon the natural decay or wearing away of the materials forming the sewer.

(1) *Defective junction of branch sewers with main sewers.*—Where a branch sewer meets a main brick sewer at the same invert level, this has been altered, wherever the gradient would admit of it, by raising the invert level so that it outlets into the main at its proper relative level and running the gradient out to meet the ordinary gradient of the branch sewer—the work being executed in Portland cement concrete. Where a branch meets the main sewer at right angles, the junction is altered to a curve of moderate radius.

(2) *Sewers decayed and worn.*—In the case of repairs consequent upon the natural decay or wearing away of the materials forming the sewer, the mode of procedure is as follows:

(*a*) *Pointing.*—After cleansing and examination the class of repairs required is decided upon. In some cases the raking out of the joints of the brick-work, washing it, and repointing in Portland cement mortar mixed in the proportions of 1 of cement to 1 of sand will meet the case.

(*b*) *Pointing and re-inverting.*—In some instances the invert of the sewer is found to be worn away, or constructed so unevenly as to assist the formation of deposit. In this case, in addition to the pointing already described, the invert of the sewer is improved in cross section and gradient, the mode of procedure being as follows:

The sewer being cleansed, the joints are raked out, as before stated, and the sewer is re-inverted with Portland cement concrete averaging 2 parts of river gravel to 1 part of cement, the surface being finished in the proportion of 1 part of cement to 1 part of gravel.

This mode of treatment constitutes the work executed in the majority of the old sewers dealt with in the parish of Liverpool.

Owing to the large dimensions of the main sewers, the whole of the operations in connection with their repair are conducted without in any way disturbing the pavements; the work is executed between man-hole and man-hole, the sewage in the sewer operated upon being dammed back at the point under repair and provision made for the discharge of the sewage through pipes or open troughs suspended irom the portion of sewer undergoing repairs. After the lapse of about four days from completion of the respective repairs the sewage is again allowed to flow through the sewer.

(1) *Defective construction or workmanship.*—(*a*) These consist generally of sewers driven in headings prepared for 9 inch work. The sewers have only been executed in 4½-inch work, except at the termination of each center length, the space between the brick arch and the rock roof, including the space for the 4½-inch ring of brick-work omitted, not being filled in with any material.

(*b*) Sewers for which the headings have been taken out considerably larger than actually required for the size of the sewer and thickness of brick-work, and this extra space in the heading above the 9-inch brick-work has not been filled in.

These sewers are practically the same as shown in drawing No. 2, figures 1 and 2, with the exception that the thickness of the brick-work of the arch is 9 inches throughout.

In heavy storms they will probably run full and under considerable pressure, and when these defects exist the crown of the sewer is lifted and the arch fractured. Their reconstruction consists in re-arching and filling in the headings solid. The inverts of many of these sewers are, in addition, found to have worn away considerably, and advantage is taken, when executing the work of re-arching, to reline the invert with radiating blue bricks.

Examples of defects *a* and *b* have occurred as follows, viz: Bankhall relieving sewer, from Stanley Road to the canal, is a type of the class *a*; in 1883 the arch of this sewer was reconstructed and the invert lined with blue bricks. Sandhills Lane outfall sewer, which is 6 feet by 4 feet, is an example of *b* as described; the portion passing under Great Homer street and Smith street has already been completed, and the length passing under Lambeth Road and Sandhills Lane has been recently commenced.

(2) *Sewers driven in the sandstone rock.*—The next description of sewers which require reconstruction are those which are found on examination to be simply headings driven through the sandstone rock neither in line nor level. New brick sewers were constructed within these headings in proper direction and level, the remaining portion of the heading being carefully filled in. Types of sewers which have been recently dealt with were situated in Catharine street, Canning street, Percy street, Huskisson street, etc.

(3) *Brick sewers past repair.*—Sewers past repair, owing to natural decay of the materials of which they are formed, and therefore required to be constructed anew. When these sewers are reconstructed, advantage is taken, wherever possible, to improve their level, gradient, and cross section. Types of sewers recently dealt with were Waterloo Road, Bath street, Grundy street, Errington street, Haigh street, and Dingle outfall sewers.

(4) *Pipe passage sewers.*—These sewers, when found to be defective, are reconstructed. Generally, those dealt with have been laid for many years; and the defects in them consist principally in the quality of the pipes and mode of joining. In many cases, owing to the ground being filled in ground, its subsequent settlement has caused inequalities in the line of sewer and breakages of the pipes, resulting in stoppages and rendering any thing short of reconstruction unsatisfactory. Such sewers have generally been found in the older residential parts of the city.

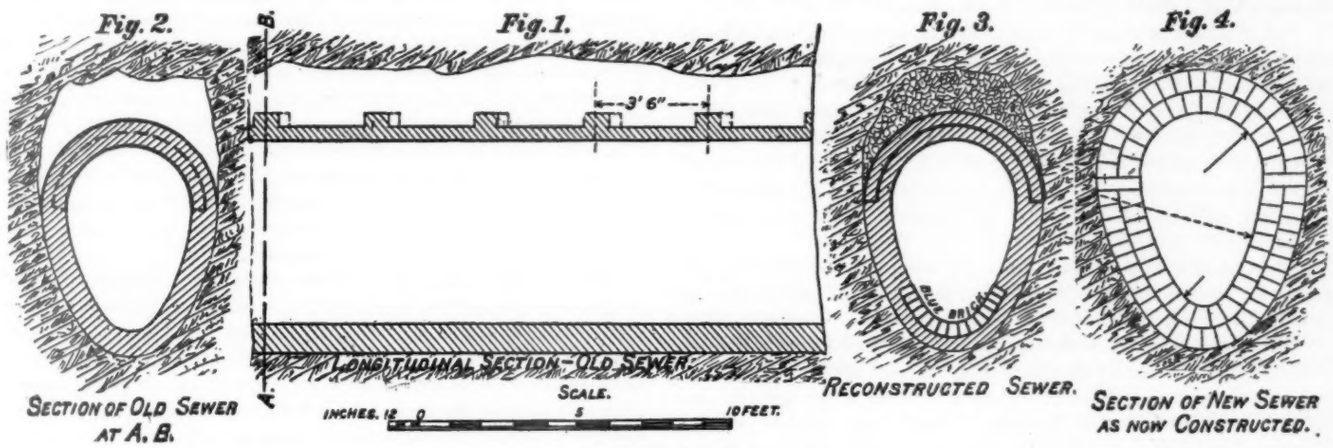
Since 1879, 14 miles of main sewers, mostly of large capacity, have been reconstructed at a cost of £51,739.

by diminished cleansing of the sewers repaired, and preventing the necessity of reconstructing the sewers so dealt with at some future time at considerable cost.

When large volumes of hot water discharge into a sewer and can not be prevented, and where wastes from chemical or other works empty into it, special means of ventilation other than by open grids is necessary, and in certain cases it may be preferable to construct a special drain for these discharges.

In order to ascertain the permanency of repairs executed as already described, the engineer has caused a careful examination to be made of eighty of the sewers, selected at random, which were repaired between 1873 and the present time.

The selected sewers in which repairs have been executed during the years 1873–75, and which may be taken as representative ones for those years, have evidently had little done to them, the principal work being cementing the invert and rough pointing. Some of these sewers may probably require to be again repaired within a period of from ten to fifteen years. The amount expended in these sewers has evidently been small, and consequently the repairs in them can not be expected to last so long as those done at subsequent periods. The expenditure, however, has been more than recouped by the saving effected in cleansing them and their increased efficiency. From 1876 to 1878 the repairs executed have been of a far more substantial character, and may reasonably be expected to last many years. From 1879 to date the repairs have been executed strictly in accordance with the methods previously described, and



DRAWING No. 2.

All new brick sewers are generally constructed in accordance with drawing No. 2, figure 4, with bricks molded to the respective *radii*, and in certain cases the invert is lined with best radiating blue bricks.

The following table shows the area dealt with from 1873 to 1885, inclusive:

Years.	Acres.	Miles of sewers repaired.
1873–'75	206	13
1876–'79	781	28
1880–'85	657	37¼

The results from these repairs have been most satisfactory, both on sanitary and economical grounds.

(1) The freedom from deposits in the sewers and a quicker discharge of the sewage to the respective outfalls, and consequent lessened impurity of the sewer air, which can thus be more readily rendered perfectly innocuous by dilution with fresh air through the open gratings fixed over the sewers. When the main causes of the impurity of the sewer air, viz, deposits in the sewers, are removed, open grid ventilation, as adopted in Liverpool, by which means the sewer air is diluted, is an effective system which can be carried out at a moderate cost.

(2) On economical grounds the repairs have been satisfactory, the quality of the work can not well be improved; the sewers as now repaired are practically equal to new ones.

The superiority of the work in recent years is readily accounted for—all the men now engaged upon the work are well trained in the various classes of repairs requisite. Skilled bricklayers are employed to execute the work, which, in addition, is carefully supervised. Portland cement concrete or mortar only is used.

In 1882 the engineer prepared draft by-laws with respect to the drainage of buildings. They were duly approved by the health committee, and were subsequently confirmed by the local government board in November, 1883. From this date all new buildings erected in the city have been drained in conformity with these regulations, which are found to work satisfactorily.

Except in the center of the parish of Liverpool, the houses are drained on what may be termed the "back drainage" system, the drains discharging into the passage sewer at the rear of the premises, avoiding the necessity of any of them passing under the buildings, and admitting of the houses being drained on the best sanitary principles, and affording easy means for their periodical inspection.

The estimated cost of executing the drainage of a cottage house in Liverpool under these regulations, inclusive of closet pan and siphon, siphon trap and waste from sink, also bath waste, is, in the case of a cottage house with an external water-closet, £3 10s., and, with an internal water-closet in addition, £4 5s.

With such additional appliances and fittings as may be requisite,

the system of drainage adopted for the cottage house is equally applicable in degree to the largest houses in the city. The highest sanitary standard of house drainage is extremely simple in arrangement and need not necessarily be expensive, but, on the other hand, can in ordinary cases be carried out at such a moderate expenditure as should encourage owners of house property to reconstruct the drainage of same where it is not in accordance with the most modern practice as defined by these drainage regulations.

All main sewers that are not self cleansing are periodically flushed by large movable tanks placed over a man-hole on the sewer. These tanks contain 1,800 gallons of water, and discharge their contents into the sewer through a valve at the bottom of the tank in twenty-eight seconds. The cost of this work is about £1,200 per annum. All passage sewers are flushed four times annually by special gangs, either from chambers at the head of each sewer or by hose connected with hydrants fixed in convenient positions, and, in addition, they are indirectly flushed twice annually by the private drains flushing gang. The cost of this work is about £1,100 per annum.

In December, 1880, on the recommendation of the engineer, the health committee resolved to flush all private drains twice annually, free of cost to the occupiers, and oftener on payment of a small fee, regulated according to the ratable value of the premises, and this work has since been regularly carried out. It is so arranged that a flushing gang visits each house in the city once every six months.

The staff for this work comprises one flushing inspector, one foreman, and sixteen gangs of three men each.

The drains, water-closets, and soil-pipes within the curtilage of all premises are flushed by hose attached to hydrants fixed at convenient distances in the passages or adjacent streets.

The occupiers of the houses willingly co-operate and afford every facility for executing this important sanitary work, and, although one hundred and seven thousand houses, exclusive of warehouses, stores, offices, etc., are visited twice annually, few complaints reach the department relative to the manner in which any of the operations are conducted.

The cost of this work is £5,000 per annum, or under 6*d.* per house for each flushing. In all cases the water is supplied free of cost by the water committee of the corporation.

This work has only been carried out systematically since October, 1885. Previous to that date, however, all sewers were examined wherever connections were made with them for the drainage of property, also prior to cleansing or executing repairs or other work, and reports made as to their condition either by the sewer inspectors or workmen engaged, so that practically the inspectors and workmen were conversant generally with the condition of the sewers. The periodical inspection of all the sewers is, however, preferable.

From the table annexed it will be seen that the majority of the repairs up to the present date have been carried out within the parish. The engineer estimates that the corporation has expended, from 1873 to date, the following sums in repairs and cleansing consequent on repairs:

Years.	Parish of Liverpool.	Township of Kirkdale.	Township of Everton.	Township of West Derby.	Township of Toxteth Park.
1873–'79	£19,520	.....	£600	£200	£1,270
1880–'85	59,486	£1,955	3,795	4,269	3,650
Total	£79,006	£1,955	£4,395	£4,469	£4,920

During this period 78¼ miles of main sewers have been repaired at a total cost of £94,745. Of this mileage 62¾ miles are in the parish.

PAVING IN SEVERAL CITIES.

LONDON has 1,718 miles of roadway, of which 573 are macadam 280 granite, 53 wood, 13½ asphalt and 798½ flints or gravels. Wood and asphalt give the greatest satisfaction there. In Paris, asphalt is more generally in use and favor; in New York, Belgian blocks are the favorite; in St. Louis, square granite blocks; in Nashville, Alleghany City, Wheeling and other smaller towns, creosoted or fire-bricks.

NATURAL AND ARTIFICIAL CEMENTS.

THE cements now in the market are of two kinds: natural, made directly from stone, and artificial, commonly called Portland cement. The manufacture of the former consists simply in burning and grinding the cement stone, a magnesian limestone containing about 15 per cent. of silica and a little silicate of alumina. The burning drives off the small amount of combined water and all the carbon dioxide from the stone, leaving the lime and magnesia as oxides, while the grinding to a powder puts it into the best possible condition for mixing with sand and gravel, and moistening to form a mortar. Artificial cement consists of about 62 per cent. of lime mixed with silica and silicate of alumina in nearly the same proportions as those found in cement stone, and it is free from magnesia. This seems to be the whole difference in its construction. In use, the artificial cement sets rapidly and attains maximum hardness in a comparatively short time; the natural cement hardens rather slowly and reaches its maximum hardness only after a long period of exposure to the air.

The increasing use of cement in modern construction, either alone or more commonly as mixed with sand and gravel, demands that the qualities of the different kinds, and means of testing, both roughly and accurately, should be generally understood.

The foundations of all important structures, in situations where they can not rest directly upon solid rock, owe their strength to cement. They are usually made of concrete, cement mixed with sand or gravel, and they are often strengthened by iron beams so as to bind the whole into one continuous mass. Tunnels under rivers, sewers, cable trenches, and all the numerous sub-ways of our great cities, are either concrete or masonry laid in cement mortar. Their strength, again, is the strength of the cement used. And even the piers of most of the large bridges are made in part or wholly of concrete. Oftentimes, even the walls of stone and brick buildings are rendered more secure by being laid up with mortar of which cement forms a large ingredient. Used for so many purposes, the necessity of uniform quality, and proper knowledge of the quality of cement used, become plain.

Before examining the methods of testing now employed and comparing the results, the process of hardening needs to be comprehended. Some things are not yet quite clear in it, but it is certainly in the main a chemical process. Mixed with water, the lime and magnesia of cement unite to form a hydrate, and it is probable that the silicates also recombine with some of the water. This is the first step, and produces the so-called setting. It is best passed through while the cement is exposed to the air, and is the reason why cement mixtures must be used as soon as moistened. But, this now complete, a more complex process is set up. The moistened cement brought in contact with the air, or exposed to water, at once begins to absorb carbon dioxide, for all ordinary air contains the gas, and most water holds it in solution. The gas unites with the lime to form a carbonate again, and this goes on until the whole of the lime is turned back to limestone. The same change occurs in the magnesia, but in this the action proceeds more slowly. With a pure lime cement this action is probably nearly complete at the end of a few months; but with a cement containing magnesia it will continue for many years. The strength of the cement increases so long as the change continues. So a Portland cement will develop its full strength in a few months, while our natural cement will not for years, and, so long as it continues, the structure improves.

Rough testing of cement, so as to enable a workman to get a crude and imperfect idea of its value, is easy. Enough of the pure cement should be taken to make a ball an inch in diameter and mixed with just sufficient water to make it mold readily and be rolled into a ball. Then it should be exposed to the air and left for two hours. At the end of that time it shold be set; then it should be put into water and left. It should grow gradually harder, and should show no signs of cracking or crumbling even when left for ten days. Any cement that does not endure this test is not of sufficiently good quality to make satisfactory structures; any cement that stands this properly will be generally satisfactory if properly used.—*Prof. La Roy F. Griffen in Popular Science Monthly.*

A CITY ENGINEER'S DUTIES.

THE councils of Salt Lake City, Utah, recently passed the following ordinance defining the duties of the city engineer for that place, which, with some modifications, may be adapted to other cities of the same class:

SECTION 1. There shall be appointed on the first Tuesday of April, 1890, a city engineer, whose term of office shall be two years, or until his successor in office shall have been duly appointed and qualified.

SEC. 2. Before entering upon the duties of his office the city engineer shall give a bond in the sum of $5,000 for the faithful performance of his duties.

SEC. 3. It shall be the duty of the city engineer to locate the lines and grades of all streets and sidewalks, alleys, avenues or other public ways, and to determine the position, size or construction of all sewers, water-works, irrigation or drainage canals, reservoirs, culverts, conduits, aqueducts, bridges, viaducts or other public work or appurtenances, and to prepare plans, maps or profiles of the same, and to make estimates and furnish specifications for any of said work whenever required to do so by the mayor or city council. He shall have general supervision of all contract or other work, and see that it is performed in a workmanlike manner and in accordance with the authorized plans, and in conformity with the terms of the contract and specifications.

SEC. 4. It shall be the duty of the city engineer to make, as soon as the time and means at his command will allow, a complete resurvey of the entire city, including all streets, sidewalks, alleys, avenues, public squares, parks and all public or private lands, which shall constitute and be the official survey of the city. And all lines thereby established shall be perpetuated by substantial and permanent stone monuments, or otherwise, as the city engineer may determine.

SEC. 5. As the work of the resurvey of the city progresses, a corrected map of the official survey shall be made, showing all streets, alleys, avenues, or other public ways, also all public squares, parks, public buildings and lands and all prominent and permanent topographical features within the city limits, and said map shall be corrected from time to time to conform to such changes as shall be made.

SEC. 6. The city engineer shall keep in his office certified copies of all the field notes, maps or profiles which relate to the city surveys, water-works, sewers, irrigation system, streets or sidewalks, and to all other engineering works, and he shall arrange and index them in such manner as will enable a ready reference thereto, and all shall be the property of Salt Lake City.

SEC. 7. As soon as the official survey, hereinbefore authorized, shall have been extended over any portion of the city, it shall be unlawful for any person or persons to commence the erection of any building upon the line of any street or public highway, embraced within the limits of such survey, without first applying to the city engineer for the line and grade of such street or highway, and thereupon it is made the duty of the city engineer to establish the required line and grade before the erection of such building shall have been commenced. And if any person shall violate any provision of this section he shall, upon conviction, be fined not less than ten nor more than fifty dollars.

SEC. 8. The city engineer shall be allowed to charge and demand in advance, for the benefit of the city, the following fees from the owners of property ordering work to be performed, or against whom the work is properly chargeable. In all parts of the city over which the official survey shall have been extended, or when the surveys are found to agree substantially with the recorded plats thereof:

For surveying each lot having more than 25 ft. and not exceeding 60 ft. front, $5.

For each additional lot of the above dimensions, contiguous thereto and owned by the same party, $2.50.

For surveying each lot having not over 25 ft. front, $4.

For each additional lot of the last above dimensions, and belonging to the same party, $2.

For establishing street and sidewalk grades for any frontage not exceeding 60 ft., $4.

For establishing street and sidewalk grades for any frontage over 60 ft., and not exceeding 100 ft., $5, and for each additional foot 5 cents per lineal foot.

SEC. 9. In all parts of the city over which the official survey has not been extended, and where the surveys are not found to agree substantially with the recorded plats thereof, the city engineer shall for all surveys in such districts charge and collect in advance a sum estimated to cover the proper cost or expense thereof, and upon ascertaining such cost or expense, any excess thereof shall be refunded to the applicant; and in case of surveys in such districts where lines can not be satisfactorily determined to agree with the recorded plat, the city engineer may refuse to give any certificate of survey.

SEC. 10. The city engineer may appoint the following assistants, or such of them as may be actually required for service in the city engineer's department, who shall be paid while in said service not to exceed the following rates, to wit:

One first assistant engineer at $150 per month.
One second assistant engineer at $125 per month.
One chief draughtsman at $125 per month.
One assistant draughtsman at $100 per month.
Two rodmen at $75 per month each.
Two chainmen at $65 per month each.
One inspector of sewers at $125 per month.

One clerk at $100 per month, and such other assistants as the necessities of the service may demand to be paid out of the city treasury at the end of each month in which such service shall have been rendered and duly vouchered. Provided, that the city engineer, before appointing any of the assistants enumerated in this section, shall submit to the city council a statement setting forth the necessity for such assistants and the appointment thereof, and obtain the consent of the council so to do.

SEC. 11. All fees and revenues of whatever kind, received in the department of the city engineer, and arising from the official acts of the city engineer or any of his assistants, shall belong to the City of Salt Lake, and the city engineer shall collect and receive the same and turn them into the city treasury in the manner provided in such cases, and he shall as often as once every three months report the actions and doings of his department to the mayor and city council.

SEC. 12. The city engineer shall devote his personal time and attention to the duties and requirements of his office, and shall receive therefor such compensation as the mayor and city council may fix.

SEC. 13. If any person shall interrupt or molest said city engineer while engaged in his official duty, by riding or driving any horse or animal or vehicle of any kind against the person or surveying instruments or other professional apparatus of said city engineer or any of his assistants, or by moving or displacing any stake or other landmark fixed or determined by him or his assistants, or by wilfully causing or offering them any kind of corporeal injury or hindrance, such person so offending shall upon conviction thereof be fined in any sum not less than $5 nor more than $100.

SEC. 14. The office of city surveyor is hereby abolished, and the duties of said office as fixed by law and ordinance are hereby imposed upon the city engineer.

A CITY IS JUDGED BY ITS STREETS.

IT is just so much waste of the taxpayers' money to expend it in improving a street, when the improvement consists of a shallow foundation and a bunglesome throwing together of the surface material, which, under no circumstances, can be expected to withstand the wear and tear of heavy drayage. A stranger judges a city by its streets quicker than anything else. If he sees well-paved streets properly kept he knows that the people have a care for their own comfort and a pride in their public highways, that either in city or country roads can always be taken as a sign of prosperity.—*Memphis Democrat.*

PAVING AND MUNICIPAL ENGINEERING

A Journal Devoted Specially to Street and Sidewalk Paving, Sewerage, Water-Works Construction, Street Lighting, and all Matters Pertaining to Municipal Engineering.

Published on the 15th of Each Month.

WILLIAM FORTUNE, Editor. - - - WILLIAM C. BOBBS, Business Manager.

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Communications are invited, and all requests for special information on the subjects treated by this journal will receive careful attention.

Articles relating to the different branches of municipal engineering are desired. Stamps should accompany manuscripts for return postage if unavailable.

ECONOMIC IMPORTANCE OF BETTER ROADS.

THE business organizations of America owe to the interests which they represent the encouragement of road improvement, and, where the sentiment in favor of better highways has not been brought into properly directed activity, they should make it their duty to start agitation for improvement and endeavor to secure the enactment of better laws relating to road work. Many business organizations of the country have given evidence of appreciation of the public importance of good roads, and the commercial development resulting from them, by attempting to secure advanced legislation on the subject, and by giving special attention to street paving in their own cities. It is capable of demonstration that the disadvantages of the farmers and the consequent stagnation of business in trade centers resulting from the extremely bad condition of the roads during certain periods of the year causes a loss of millions of dollars annually in America. The farmer, the retailer, the wholesaler, the manufacturer and the railroad companies can give very important testimony on the subject. The effects are not wholly local. They are in a large measure general.

Though the movement for better roads has within a few years had very remarkable growth in the majority of the States, no steps have been taken to secure improvement by organized effort. If commercial organizations and boards of trade in all of the leading cities would make the matter of highway improvement a subject for the special attention of some committee, and if a determined effort should be made in all states to secure the enactment of better laws, the good work would be speedily advanced and the results would be incalculably beneficial in the development of prosperity.

It is necessary that as a first step toward improvement, there should be much educational work done. The road supervisors who, under existing systems, have charge of the work of improvement, need a better understanding of their duties. It is necessary that simple methods of instruction should be provided for their benefit. The road congresses which have been formed in several States have been helpful, but are not likely to be made successful in all States. A better way of providing the needed instruction would be for the States to make adequate provisions for the support of Road Improvement Institutes, to be held for a period of about two weeks each year at convenient points, where road supervisors and others interested, can be brought together to receive instructions from men who have thorough knowledge of how the work should be done. A corps of these instructors could hold institutes at eight or ten points in a State during the winter months, and the cost of the instruction would not be more than a few thousand dollars to the State, while it would certainly result in a saving of many times the amount of the expense now annually wasted in making repairs that are merely temporary.

THE DEMAND FOR PAVING BRICK.

THE paving problem is endlessly perplexing. Complaints which are now becoming very common indicate that the ever doubtful question of what material shall be used is not more troublesome than the question of how shall the desired material be obtained. This is particularly true as to vitrified brick. A few years ago it was, as a paving material, known as a little tried experiment, but, in spite of expressed doubts as to its merits, it has rapidly grown in popularity, and to-day there is a demand for it greatly in excess of the supply. It is not now so much a question of using it as of getting it. Information comes to us regarding many cities that desire to pave their streets with brick, but are unable to get the material. This is in a measure due to attempts of capitalists to acquire a monopoly of the supply, but mainly and necessarily to the fact that the demand is larger than the supply. The inequality is growing rather than lessening. So far as we are able to learn, there is not a manufacturer of paving brick in the country who has not got his output sold in advance—many of them for one and two years. There is urgent need of more manufacturers, and everybody engaged in the business in the right way is sure to find it profitable. Clay of the requisite qualities for the best brick is found in many parts of the country, and there is a demand for the product wherever there are cities and towns with streets to be paved. The necessary equipment for the business can be procured for a few thousand dollars. The business is one that seems to hold out tempting inducements to those who have the required money and are willing to adapt themselves to it. There are indications that it has almost unlimited possibilities of development, and success awaits any manufacturer who can produce what is regarded as a first-class paving brick or block.

THERE is nothing more important to be learned from the example of municipal engineering in Liverpool described in an article which appears in this issue, than the precaution taken by the city to protect its street pavements after they are put down. The statement is made that "permission is never given to private companies to cut through a pavement for any purpose." When an opening in the street is necessary it is made by the employes of the municipality, and the work is done with the greatest possible care.

Next to wear and weather the pavements of our city streets suffer from nothing more than the openings that are made in them by companies which find it necessary to cut into them to reach or lay pipe-lines. The repairs are hardly ever properly made, and in the course of a few years a pavement may be ruined by such work alone. If cities could have an underground conduit system all this would be obviated, but in the absence of it precautions should be taken in much the same way as in Liverpool to protect pavements from ruin by heedless and careless companies. Pipe-laying and service connections should be required for all property on a street before expensive pavements are put down, and afterward they should only be disturbed in cases of extreme necessity.

A NUMBER of our readers have very kindly responded to our request to return to us copies of the first number of PAVING AND MUNICIPAL ENGINEERING, but the supply is not near equal to the demand. We have received many applications for the number from persons who desire a complete file, and orders for it continue to come in. We should like to comply with as many of these requests as possible, and again we ask all who may have copies of the number which they can spare to mail them to us. We will gladly pay ten cents a copy for all we can get. Those who return papers should send with them their name and address, in order that we may know to whom we are indebted.

WE have been very gratifyingly favored with information, suggestions and contributions from persons interested in the various branches of work to which PAVING AND MUNICIPAL ENGINEERING devotes attention. These favors are desired and are much appreciated. All persons who have anything to do with municipal engineering are invited to make this publication the medium for presenting their views and observations to the public. We are glad to receive suggestions, and items of information, copies of official reports, and articles on engineering subjects are always desired.

FIRE BRICK FOR PAVING.

IN commenting upon the opinion of the city engineer of Columbus, O., as to the relative durability of different kinds of paving material, which was published in the August number of PAVING AND MUNICIPAL ENGINEERING, Mr. Peter Simple controverts the statement made as to the wearing qualities of ordinary brick. The city engineer of Columbus gives it as his opinion that the comparative probable wear of the different kinds of material will be found to be as follows: Granite, or Medina stone, 40 years; Hayden, or Hallwood block, 20 years; Asphalt, 15 years; Fire brick, 10 years; Red brick (ordinary), 5 years; Red brick (best quality), 10 years; and explains that he places ordinary red brick so low on the list because "no manufacturer has yet produced a red brick of reliable uniform wearing quality in any quantity large enough to be of much account in street paving. The fire brick people have done better, but are far from perfect as yet."

Mr. Simple, in a communication to the *Clay-Worker*, says of this: "A more unjust and false statement of facts could not well have been made. That is, if he intended to put all brick that are not fire brick into one class, and call them 'red brick.' If he did not so intend, then why does he fail to mention vitrified brick in his comparative table of wear. If he omitted them intentionally, then he is culpable; on the other hand if he included all except fire brick in the red brick class, he is either ignorant of the facts or wilfully misrepresents them. There are towns and cities in his own state that have brick pavements that were laid with vitrified or semi-vitrified brick that have been in use from four to eight years that give promise of a wear of fifteen or twenty years. At Charleston, W. Va., they have one of their principal streets paved with what are called fire brick, that was completed seventeen years ago, and the writer has been credibly informed that this street gives promise of a wear of almost as many more years, without any considerable repair. At Bloomington, Ill., there is a square in length on the west side of the court house that was paved with common sand-molded brick fourteen years ago, that has been in use on one of the principal streets of the city all that time, and gives promise of several more years wear, with but little repair. At Decatur and Galesburg, Ill., and many other points, brick pavements are in use that have had a wear of from five to ten years that give promise of twenty or thirty years wear, with little expense in the way of repairs. There is much more in the way of proof that might be given as to the merits of brick paving, but it is unnecessary.

"Notwithstanding the sweeping condemnation of brick as a paving material by the Columbus engineer, the fact remains that towns and cities that have had experience in the use of brick paved streets continue to lay more of them, even many more of them."

AS OTHERS SEE US.

A BROAD, RICH FIELD.

PAVING AND MUNICIPAL ENGINEERING is the title of a new monthly journal published by Wm. Fortune and Wm. C. Bobbs, of Indianapolis, Ind., which is to be devoted to municipal improvement generally and street paving in particular. This is a broad, rich field, that with proper cultivation will yield a golden harvest both to the publishers and their readers. There is not a city or town in all our broad land that does not stand in need of better information on this most important subject. The better improvement of streets and driveways is demanded universally and PAVING AND MUNICIPAL ENGINEERING can, with proper effort, supply a fund of technical yet practical knowledge that will make it well nigh invaluable. The publishers are well known enterprising, capable and reliable young men, who, we are sure, will prove equal to their opportunities.—*Clay-Worker.*

A NECESSITY BEFORE ISSUED.

PAVING AND MUNICIPAL ENGINEERING is the title of a new monthly magazine that had become a necessity before the first number was issued. The Indianapolis Street paving Exposition, and the prominence given Indianapolis as a center of information on the subject of street improvements, brought to light the fact that there was no direct medium of communication existing by which the numerous interests could communicate with each other or the public, editorially or otherwise. The success of the exposition and an immense correspondence growing out of it, made the adoption of systematic methods of gathering and imparting information a necessity, and the new journal is the result. It is a handsome sixteen-page monthly, starting off with a paying list of advertisements that speak well for the enterprise of the publishers. William Fortune is editor, and William C. Bobbs, business manager.—*Rough Notes.*

A FIELD THAT HAS NOT BEEN PROPERLY FILLED.

A new monthly, the field of which is indicated by its name—PAVING AND MUNICIPAL ENGINEERING—has been started in Indianapolis, with Mr. William Fortune as editor. The current issue has several very interesting articles, and there are some contributions of note on the list. The field is one that has not been filled properly by existing journals, perhaps, and our new contemporary, we hope, will meet with deserved success.—*Railroad and Engineering Journal.*

WELL WORTH THE PRICE.

Such issues of PAVING AND MUNICIPAL ENGINEERING as we have seen indicate that it will be well worth the price to anybody interested in the subjects of which it treats.—*Railroad Gazette.*

Paving and Grading.

Main street in Evart, Mich., will be paved.

Numerous streets are being paved in Waco, Tex.

Several streets of Littleton, Col., will be graded at once.

A new road will be laid out in North Shelburne, N. H.

Central Ave., West Duluth, Minn., will be paved next spring.

Middletown, N. Y., is agitating for Belgian block pavements.

Considerable paving work is contemplated in Braddock, Pa.

Important street work is in progress at Sherman Heights, Tenn.

Maine street, St. Joseph, Mo., is being paved with vitrified brick.

The subject of brick pavements is being agitated in Jackson, Mich.

Sundry streets of Greenbush, N. Y., will be paved with Belgian block.

Considerable asphalt paving work is contemplated in Philadelphia, Pa.

An application is in for paving of Commerce street, Montgomery, Ala.

Vitrified brick pavements will be laid on sundry streets of Kingston, Pa.

Considerable street paving is contemplated by the citizens of Braddock, Pa.

Contractor Adams, of Detroit, Mich., has the contract for paving Michigan street.

The City Council of Ludlow, O., has ordered improvements on Adelia avenue.

Ten thousand dollars will be expended in improving the streets of Marion, Me.

Chas. Wilson has been awarded the contract for paving streets in Quincy, Mass.

Market street, Steubenville, O., will probably be paved with fire brick next spring.

The Mayor of Salem, Mass., recommends the issue of bonds for street improvements.

Considerable street improvement work is contemplated in Lonaconing, Md., at once.

A part of First street in Louisville will probably be paved with brick as an experiment.

Wilmington, Del., contemplates paving sundry streets with Belgian and granite blocks.

Melrose, Mass., has ordered sundry streets improved and a stone crusher purchased.

A movement is on foot for the construction of a boulevard from Denver to Littleton, Col.

The Brocton, Mass., Council has authorized the borrowing of money for street improvements.

Keeling & Ridge have been awarded the contract for asphalting several streets of Pittsburgh, Pa.

The Council in Black Rock, N. Y., has passed an ordinance providing for paving several streets.

It is probable that the city council of Council Bluffs, Ia., will soon let a mammoth contract for brick paving. A number of the council favor advertising for bids to furnish 5,000,000 brick.

Five hundred thousand dollars is to be appropriated for the improvements of the streets of Roanoke, Va.

The board of directors of the street department in Wilmington, Del., want estimates for paving blocks.

The Woodside Improvement Association contemplate extensive work on road construction in Woodside, N. J.

The city council of St. Joseph, Mo., at a recent meeting, decided to issue an order for the paving of Olive street.

O. H. Ernest, Washington, D. C., may be addressed regarding considerable asphalt paving work to be done there.

The right of way has been secured for Mount View boulevard, which will soon be constructed in Denver, Col.

Forty thousand dollars will be expended at once in macadamizing and improving sundry streets of Flushing, N. Y.

Footways paved with asphaltum block is an improvement for Druid Hill Park in Baltimore that is strongly urged.

A new boulevard in Rochester, N. Y., will be opened and constructed from Driving Park Ave. to the Stone Tavern.

The council has passed several ordinances providing for paving and improving numerous streets of Newark, N. J.

The city council of Atlantic City, N. J., at its last meeting ordered extensive paving work and the purchase of a road roller.

At the next council meeting definite action will be taken on the matter of extensive street improvements in Chelsea, Mass.

Resolutions have been passed by the city council of Toledo, O., for the improvement of a number of streets by paving and grading.

The board of supervisors are considering the issue of $70,000 of bonds for macadamizing sundry streets in New Hempstead, N. Y.

The managers of St. Mary's Hospital will hold a fair to raise funds for the improvement of Missouri avenue, East St. Louis, Ill.

A Vicksburg and New Orleans firm has secured the contract for graveling four miles of levy front of New Orleans at a cost of $120,000.

A petition has been presented to the City Council of Buffalo, N. Y., for the paving of Seneca street from Main to Erie with asphalt.

There is agitation in Baltimore in favor of paving more streets there with asphaltum blocks, among those named being Lafayette avenue.

Resolutions have been passed by the City Council of Dubuque, Ia., for the construction of a number of cement sidewalks throughout the city.

Paving will soon be begun on Fourth street, West Duluth (Minn.), in which street the gas and water companies are now laying pipe lines.

The street commissioner of Trenton, N. J., has ordered an extensive amount of street improvement work, details of which may be obtained by addressing him.

A number of the streets in Louisville, Ky., are being covered with asphalt pavements, and the council has been petitioned to take steps to provide means for their preservation.

The Kansas Paving and Construction Company, of Kansas City, Kan., has contracted for the paving and curbing of Minnesota Ave. between 8th and 18th streets.

The suburban street schedule recently completed by Captain Rossell, foots up a total of $272,478.93 to be expended in the improvements of streets throughout the surburbs and city of Washington, D. C.

The city council of Columbus, Ohio, has passed a resolution for the grading and paving of Avon Court from Lexington to Garfield Ave. Similar resolutions have been passed for the improvement of several other streets.

A block of the new jasperite pavement will be tried in Dubuque, Iowa, in front of the Hotel Julien, between Second and Third streets. The work on the single block and two intersections will cost from $800 to $900.

At a recent meeting of the Board of City Commissioners of Dayton, O., the City Auditor was authorized to advertise for proposals for grading and graveling a number of streets, and for paving and curbing a number of others.

The Colorado Paving and Improvement Company, of Denver, has incorporated. Capital, $500,000. Incorporators, Dennis Sullivan, Finis P. Earnest, Chas. B. Rhodes and ex-Senator H. A. W. Tabor. The company manufacture and lay all kinds of paving material.

The amount of paving in New York City on July 30, 1890, was 8,277,623 sq. yds., of which 2,225,811 sq. yds. were specification granite; 673,402 sq. yds. block granite; 1,248,529 sq. yds. specification trap; 3,045,214 sq. yds. Belgian blocks; 101,643 sq. yds. cobble-stone; 71,190 sq. yds. asphalt; 516 sq. yds. wood; 2,964 sq. yds. Russ; 908,354 sq. yds. macadam. There are 359.15 miles of paved streets within the city limits.

The total amount of new pavement and repavement for which contracts have been let in Detroit is $483,516.39. Pavements have been ordered on thirty other streets as follows, for which contracts have not yet been let, together with the estimated cost: Orchard, $16,000; Warren, $5,700; Buchanan, $10,900; Foundry, $16,240; Market, $5,000; Twelfth, $3,100; Congress, $14,500; Scott, $7,170; Seventh, $10,544; Labrosse, $7,130; Spruce, $15,200; Columbia, $7,420; Rivard, $13,000; Ferry, $13,250; Waterloo, $10,680; Pitcher, $4,170; Locust, $13,440; Mack, $44,100; Chestnut, $15 000; Ledyard, $1,360; Thirteenth, $12,450; Larned, $2,400; Fifth, $7 800; Milwaukee, $16,400; Scotten, $21,900; Mullett, $5,200; Waterloo, $4,500; Gratiot, $8,400; Second avenue, $51,000; Vinewood, $12,600.

Water-Works.

Ridott, Ill., has decided to put in waterworks.

The West Hoboken water mains will be extended.

The water mains of Woodbury, N. J., will be extended.

The water mains of Kingston, N. Y., will be extended soon.

New water-works are to be constructed at Wichita Falls, Tex.

Sutton, Neb., has voted bonds for waterworks to be put in at once.

A water-works system will at once be constructed at Sarento, Me.

Mains are being laid for the new water-works at Guthrie Centre, Ia.

Brockton, Mass., will borrow money for the extenson of water mains.

Lancaster, Pa., will borrow money for the construction of a reservoir.

Robinson Bros., of Athens, Ga., will erect a water-works plant at Madison.

The city council of Brockton, Mass., is agitating for a pure water supply.

The water supply system of Bridgeton, N. J., will be extended and improved.

Work will be pushed on the construction of the water-works at Hinton, W. Va.

Two water companies are trying to secure a franchise for Huntingdon, N. Y.

Steps are being taken for the establishment of water-works in Des Moines, Ia.

The water system of Hackensack, N. J., will be extended to Hasbrouck Heights.

Work on the erection of the water-works plant at Greensville, S. C., has commenced.

Specifications have been prepared for extending the water mains in Albany, N. Y.

Six thousand dollars will be borrowed for constructing a water main in Stoneham, Mass.

Bay City, Mich., is to vote in November on $50,000 worth of water-works imrovements.

The Pittsburgh South Side Water Committee will order extensions to their water system.

The City Council of Salt Lake City, Utah, is discussing the project of a new water system.

The Forrestport reservoir was extensively damaged by the recent flood and will be rebuilt.

The water system of Springfield, Mass., will be considerably extended and improved.

The Newark Aqueduct Board will construct a new water-works system in Newark, N. J.

At a special election held in Wilton, Minn., it was decided to raise $14,000 for water-works.

Work will be actively pushed on the construction of the water system in Franklinville, N. Y.

Work will be actively pushed on the construction of a water-works system at Medina, N. Y.

Frank G. Wood has been awarded contracts for extending the water mains in Newburg, N. Y.

Raymond & Campbell, of Middletown, will construct a water-works system in Millersburg, Pa.

At Marinette, Wis., improvements are being made on the water-works system at a cost of $100,000.

Parks & Wheeler will at once commence the construction of a water-works system in Winchester, Ky.

The Grand Lodge, Mich., *Republican* is strongly agitating the building of a $40,000 system of water-works.

The Mayorsville Water Company has been incorporated by John G. Mayor, Geo. S. Mayor and Wm. H. Mayor, for the construction of a water-works system in Mayorsville, Pa.

A new water-works plant is being put in at Peoria, Ill., under the superintendence of engineer S. P. Davis.

At Bellevue, O., the water-works trustees are making preparations to build a new stand pipe in the spring.

The Commonwealth Water Company will extend its mains to Summit and South Orange, in Newark, N. J.

At the next meeting of the council at Steelton, Pa., action will be taken on the question of new water-works.

The city council of White Sulphur Springs, Mont., is taking steps to secure an adequate supply of pure water.

The East Jersey Water Company contemplate the construction of a pipe line for the water supply of Newark, N. J.

The Wichita, Kans., Water-Works Company is preparing to increase its supply and contemplating improvements.

Muffett, Hotchkins & Clark, of Syracuse, have the contract for erecting a water-works system in Madison, N. J., at $56,000.

H. B. Pitcher, of Long Branch, has been awarded the contracts for extensive water-works improvements in Freehold, N. J.

The Council of Lowell, Mass., has ordered the issue of $60,000 of bonds for the purpose of pumping engines and machinery.

The East Jersey Water Company are preparing to construct a system for using Rockaway River water at Elizabeth, N. J.

At Winnipeg, Man., a special committee has been appointed to consider the water power question, and will advertise for new tenders.

Frederick H. James, Caleb H. Joseph, J. Coatsworth and J. G. Miller contemplate the organization of the water-works in Lancaster, N. Y.

Chief Engineer Kuichling has been requested to prepare plans and estimates for furnishing an additional water system in Rochester, N. Y.

The New York City council has passed an ordinance providing for construction of water mains to Blackwell's Island and throughout the island.

The Minden, Neb., council has held a meeting to arrange for putting in water-works. Bonds have been sold and work will begin in a few days.

The Terre Haute Water-works Company have contracted for a large and extensive filtering and clarifying plant, and is building additional reservoirs.

The St. Louis Board of Public Improvements have not yet let the contract for a pumping engine for the new water-works at Chain of Rocks. The pumps and engines are to cost $500,000.

Sewers.

A new sewer district will be laid out in Scranton, Pa.

Considerable sewer work is contemplated at Buffalo, N. Y.

Extensive sewerage work is contemplated in Roanoke, Va.

Considerable sewer work is contemplated in Peekskill, N. Y.

Citizens of 5th and 6th streets of Quincy, Ill., have signed an agreement to pay for the construction of sewers.

Considerable sewer work is contemplated in Lockport, N. Y.

Petitions for sewers are being circulated in Pine Hill, Mass.

Considerable sewer work is contemplated at New Britton, Conn.

Considerable sewerage work is contemplated in Reading, Pa.

Sewers will be considerably extended in Saratoga Springs, N. Y.

Considerable sewer work is contemplated in South Scranton, Pa.

The council has ordered considerable sewer work at Chester, Pa.

Considerable sewer construction is contemplated at Jamestown, N. Y.

Sewers have been ordered laid in sundry streets of Chattanooga, Tenn.

A new sewerage system will shortly be erected in Birmingham, Conn.

Lateral sewers will be constructed in sundry streets of Sing Sing, N. Y.

Collateral sewers will be constructed in sundry streets of Mt. Vernon, N. Y.

Bids will shortly be invited for constructing sewers in Bridgeport, Conn.

The sewer and water systems will be extended at once in Brookline, Mass.

Plans for an extensive sewer system for Hoboken, N. J., have been prepared.

The city engineer of North Easton, Mass., has prepared plans for a sewer system.

Somerville, N. J., is contemplating the construction of a $20,000 sewer system.

The council of McKeesport, Pa., has ordered the construction of sundry sewers.

James Finnegan has been awarded extensive contracts for sewers in Paterson, N. J.

The mayor has appointed a commission for the construction of sewers in Waltham, Mass.

W. C. Olmstead may be addressed regarding proposed sewer work at Lockport, N. Y.

Work will at once be commenced in Somerville, N. J., on the construction of a sewer system.

Important extensions and improvements of the sewer system are contemplated in Pottsville, Pa.

The township committee invites proposals for constructing numerous sewers in Kearney, N. J.

Small & Serry, of New York, have the contract for building the sewer system at Somerville, N. J.

The water board of Boston, Mass., has asked for a loan of $250,000 for extending the water mains.

J. & G. Stewart have been awarded contracts for extensive sewerage construction in Yonkers, N. Y.

Somerville, N. J., has passed ordinances providing for the construction of sewers in numerous streets.

Considerable sewer work is contemplated at Lansingburg, N. Y., proposals for which will shortly be invited.

The Board of Public Improvements of St. Louis, at a regular session on the 9th, decided to let a number of contracts for sewer building and plumbing.

Petitions are before the Brookline, Mass., council providing for the construction of sewers on sundry streets.

The citizens of Hebron, Neb., voted on the 15th in favor of a new water-works system soon to be erected.

The City Council has passed sundry ordinances providing for the construction of sewers in Newark, N. J.

The city council of Greenbush, N. Y., has adopted an order providing for the construction of sundry sewers.

The council at its next meeting will take final action on the question of sewer improvements in Orange, N. J.

The city of Marion, Ind., is considering the question of establishing a system of sewerage at a cost of $200,000.

D. J. Coutant, of Newburgh, N. Y., will shortly invite proposals for extensive sewerage construction in that city.

Thomas J. Finnegan, of West Hoboken, N. J., may be addressed regarding sewers to be constructed at that place.

Work has begun at Kansas City, Mo., on the new $50,000 sewer, contract for which was taken by Patrick McDonald.

Petitions are before the council asking that sundry sewers be constructed and others extended in Rochester, N. Y.

James Millward, Mayor of Yonkers, N. Y., will shortly invite proposals for constructing sewers throughout the city.

The committee on public improvements have recommended the construction of sewers in a number of streets in St. Louis, Mo.

Boston, Mass., has been asked for an appropriation of $75,000 for constructing sewers in the Dorchester Lower Mills district.

The Findlay, O., board of improvements have offered resolutions to the city council to place sewers in a number of streets and alleys.

At St. Joseph, Mo., the contracts for building the section of main sewer on Olive street, between Twentieth and Twenty-sixth, and for the Atchison street sewer, have been awarded to Patrick Horey.

Bridges.

A new bridge is projected at Silva, N. C.

New bridges are to be constructed at Border, Kan.

A new bridge will be built at Linlithgo, N. Y., at once.

A new bridge is proposed at Broad street, Richmond, Va.

A new wagon bridge is to be built at Louisville, Neb.

A new bridge is to be erected across the river at Minneapolis.

A foot-bridge is to be built across the river at Rockford, Ill.

Plans have been submitted for a new bridge at Augusta, Ga.

A bridge is to be constructed over St. Vrain Creek at Lyons, Col.

The Brown street bridge at Lafayette, Ind., is undergoing repairs.

A new bridge is to be built across the Santa Ana at Auburndale, Cal.

At Athens, Ga., a new bridge will be erected on the proposed boulevard.

An iron bridge will be constructed at the foot of Leonard street, Onaga, Kan.

The county commissioners will erect a new bridge at Harney, Md., at once.

Greenville, S. C., has issued about $9,000 of bonds for the construction of bridges.

A new bridge is to replace the old one over the Yadkin River at Charlotte, N. C.

A new bridge is to be constructed over the river at Union street, Olympia, Wash.

The Macon & Dublin Railroad Company will construct extensive bridges at Dublin, Ga.

A railway bridge on the Cheyenne and Northern extension is to be built at Badger, Wyo.

A bridge over the Merrimac at the foot of Swain street, Haverhill, Mass., is contemplated.

The Mayor is agitating the issue of bonds for the construction of a new bridge at Salem, Mass.

An apprcpriation of $3,000 is to be made for the construction of a new bridge at Granville, Ill.

The petition is in for a bridge across the Nueces River at Miller's Ferry, near Legarto, Tex.

Berrion and Worth counties are constructing a bridge over the Little River near Macon, Ga.

A bridge will be constructed across the Saline River on the Centre Point road at Locksburg, Ark.

A new bridge is to be built over the Kansas River on Quincy street, Topeka, Kan., to replace the old one.

The highway commissioners of South Palmyra, Ill., will let a contract for an iron bridge over Massey Creek.

Charles Stone has been awarded contract for construction of viaduct over Wisconsin Central track at St. Paul, Minn.

At Lincoln, Neb., new viaducts are to be constructed on 9th, 12th and W. O. streets, to be voted on by city council.

Bridges at Adams and Jefferson streets, Peoria, Ill., have been declared unsafe and are to be replaced by new ones.

C. Harden & Son, of McConnellsville, have the contract to build nine new bridges between Canastota and Syracuse.

City Engineer Weber, of East St. Louis, Ill., is surveying for a new iron bridge over Cahokia Creek on Missouri avenue.

The Hampton Manufacturing Company will at once commence the construction of an extensive bridge at Hampton, Va.

The Selectmen have appropriated $35,000 for the construction of approaches to the Cypress street bridge at Brookline, Mass.

City Engineer Force, of Cleveland, O., has been instructed to prepare plans for a bridge across Morgan Run at Todd street extension.

M. H. Stump has been appointed a commissioner to contract for building the approaches to the Steer Creek bridge at Glensville, W. Va.

The Wrought Iron Bridge Company of Indianapolis is to build a bridge across the Tippecanoe River at Monticello, Ind., at a cost of $15,000.

The city engineer of Wichita, Kan., has been instructed by the council to prepare plans for a pile bridge over Chisholm Creek and Douglas Ave.

A bridge is to be built at Ottawa, La Salle county, Ill., by the Wrought Iron Bridge Company of Indianapolis. Estimated cost $10,000.

Bills have been passed to provide for a wagon bridge across the Mississippi River at Hasting, Minn., and one across the Red River of the North.

The Wheeling Terminal Company will at once commence construction of their $100,000 bridge between Wheeling, W. Va., and Martin's Ferry.

The Council at Rochester, N. Y., has passed final ordinances providing for the construction of the Alexander and Edenburgh street river bridge.

The McKeesport & Duquesne Bridge Company contemplate extensive changes in the construction of their bridge between McKeesport and Duquesne, Pa.

There is talk of spanning the Mississippi River at Burlington, Ia., with a Pontoon bridge. Stewart, the Pontoon bridge builder, offers to do the work for $12,000.

The highway commissioners of Joliet, Ill., have decided to put in a new bridge on Cass street over Spring Creek this fall. It is to be of iron, full width of the roadway.

The George E. King Bridge Company has been awarded a contract by the board of supervisors of Holdredge, Neb., for the construction of a bridge over the Blue River at Blue Springs, and for several small bridges throughout Gage county.

The bids for the new iron bridge over Yellow Creek, at Middlesborough, Ky., were as follows: The Wrought Iron Bridge Company, $11,975; the Smith Bridge Company, $11,950; the Berlin Bridge Company, $11,915; the King Iron Bridge Company, $11,900; the Chicago Bridge Company, $11,990; the F. J. P. Brackett Bridge Company, $11,890; the Queen City Bridge Company, $11,990; the Massillon Bridge Company, $11,740; the Variety Iron Works Company, $11,775; the Youngstown Bridge Company, $11,500. The contract was awarded to the Youngstown Company.

Street Lighting.

An electric light plant is to be put in at Wilton, Minn.

The electric light plant is to be increased at Charlotte, Mich.

Electric lights are being discussed by the citizens of Mackinaw, Ill.

Mayor Island, at Oakland, Cal., is to have a $40,000 electric light plant.

An electric light plant is to be established in Milledgeville, Ga., at once.

The citizens of Awanton, Vt., are agitating for an electric light plant.

The citizens are agitating the question for electric lights in Keokuk, Ia.

R L. Bloomfield will at once establish an electric light plant at Athens, Ga.

The city trustees of Modesto, Cal., have granteed a franchise to A. C. Swain, of Merced, for an electric light plant. Lights to be burning in four months.

A complete system of electric lights is being put in at Council Bluffs, Ia.

The citizens of Alexandria, La., are contemplating an electric light plant.

Steps will shortly be taken to put in an electric light plant at Weldon, N. C.

Work on electric equipment has commenced recently in Rock Island, Ill.

The Hinton Electric Light Company has been chartered at Wheeling, W. Va.

The village improvement society at Plaiston, Mass., is agitating for street lights.

The Westinghouse Company is about to erect a $17,000 plant at Blairsville, Pa.

Oconomowoc, Wis., has granted a ten year franchise to an electric light company.

L. N. Cox, of Washington, will establish an electric light plant in Florence, S. C.

Centreport, N. Y., is considering the question of lighting its streets by electricity.

South Denver is to have an $80,000 electric light plant within the next sixty days.

Citizens are agitating to have the streets of West Elizabeth, Pa., lighted by electricity.

A company has just been organized to establish an electrical light plant at Hinton, W. Va.

The incandescent lighting system is to be placed on trial within a few days at Delavan, Ill.

The city council of Augusta, Ga., is contemplating lighting the entire city with electricity.

Work has been commenced on the construction of an electric light plant at Greenville, S. C.

The city council of Rockford, Ill., has in contemplation the lighting of the city by electricity.

All the leading citizens of Pender, Neb., are agitating the question of an electric light plant.

The city council of Dayton, Ky., has in contemplation the letting of contracts for electric lights.

Electric lights have been supplied to South Englewood, Ill., by the Lake Electric Light Company.

At the next council meeting in Nanticoke, Pa., some action will be taken on the electric light matter.

The Jamaica Gas Company are considering the establishment of an electric light plant at Jamaica, N. Y.

The Citizens Electric Light and Power Company, of Houston, Tex., has increased its capital stock to $50,000.

Work at Pottsville, Pa., will be actively pushed on the construction of the Edison Light Company's new station.

An electric light company at Mascoutah, Ill., has been organized, and the city is being canvassed for subscribers.

The proposition to issue $30,000 for an electric light plant at Jamestown, N. Y., carried at the recent election.

A franchise has been granted C. T. Gage, of Allegan, Mich., to put in an electric light plant at Nashville, Tenn.

The Crown Hills Improvement Society of Los Angeles, Cal., invites competition for a new system of electric lights.

The Olympia, Wash., Gas and Electric Company are enlarging their plant to meet the demands of Olympia for light.

At the recent election in Canisteo, N. Y., a proposition to light the streets by electricity carried by a large majority

The Seneca Electric Company have been awarded the contract for lighting the streets of Seneca Falls, N. Y., by electricity.

The electric light company of Martin's Ferry, W. Va., is about to furnish all its customers with an emergency lamp.

Electric lights have been ordered to be erected on a large number of streets in Chattanooga, Tenn., by the city council.

Richmond, Pa., is discussing an electric light plant, and it is probable that one will be put in next year at a cost of $75,000.

The City Council of Weedsport, N. Y., will grant a franchise to any one who will establish an electrical light plant there.

The city council of Louisville, Ky., has passed an ordinance for the appropriation of funds to introduce an electric light plant.

A committee of the common council at Oil City, Pa., has recommended the purchase of an electric light plant to cost $52,000.

At the last council meeting at Doylestown, Pa., Mr. Kane was granted a franchise for the establishment of an electric light plant there.

The Williams Valley Light, Heat and Power Co. has been incorporated with a capital of $40,000 to establish a plant at Lykens, Pa.

Reed City, Mich., has given Geo. L. Beatle and J. H. Andrews franchise to put in an electric plant and operate it for twenty years.

The selectmen at Hingham, Mass., have contracted with the Weymouth Light and Power Company to light the village streets by electricity.

A petition has been presented to the city council of New Orleans, La., for electric lights to take the place of gas lights in the sixth district.

The Roseburg, Ore., *Review* is strongly agitating the putting in of a city electric lighting plant. It estimates the cost at $10,000 or $12,000.

Canisteo, N. Y., is considering propositions from the local and outside electric light companies for lighting the streets of the town by electricity.

The borough council of Kingston, Pa., have instructed the light committee to obtain estimates for lighting the new borough building by electricity.

At Attleboro, Mass., the electric light company have raised the price from seventy-two to ninety dollars per light for lighting the streets by electricity.

Not less than seven ordinances for electric light franchises are pending before the city council of Chicago, Ill. They include in every instance the entire territory within the city limits.

At Bryersville, Pa., an electrical light company has been organized, and a $17,000 electric light plant will be put in at once. The borough has contracted to light the streets by electricity.

At a recent special meeting of the city council of Independence, Mo., the question of electric lights was brought up, and a committee was appointed to ascertain the cost of a system for the city.

Public meetings are being held in Huntersville, Va., to consider the electric light question, and a committee has been appointed to solicit funds and secure estimates for a plant. R. T. Webster is chairman and John P. Lasner secretary.

Street Railways.

A street car system is badly needed at La Grange, Ga.

A new street car line will be in operation in Evansville, Ind., within a week.

Work on the electric motor line at Quincy, Ill., is progressing rapidly.

An electric street car line will soon be in operation from Joliet, Ill., to Lockport.

The Geary street cable line in San Francisco is to be extended to Golden Bridge Park.

The South Sioux City Electric Motor Street Company will extend its lines to Dakota City.

Eleven miles of street car rails costing $24,000 have been received for the electric railway in Springfield, Ill.

The directors of the electric road at Columbus, O., are considering the extension of their line on Broad street.

An electric street railway system is soon to be established in Durango, Col., by a company organized for the purpose.

The City Council of Rock Island, Ill., recently passed an ordinance authorizing the equipment of street railways with electricity.

The Front Street Cable Company at Seattle, Wash., is to extend its road one mile further, work on which will be begun soon.

The Waco, Texas, dummy street railway company has secured a right of way on an entire line, and track-laying will commence at once.

The stockholders of the Selma Street Railway at Selma, Ala., have increased their capital stock to $100,000 for the purpose of extending their road.

The San Antonio (Tex.) Street Railway Company is introducing electric power in the place of mule power, and will soon have several lines in operation.

J. W. Hartzell has asked for an electric railroad franchise on Eighth street in Oakland, and has asked the city trustees of Allameda, Cal., for a similar franchise.

At a recent meeting of the board of directors in Walla Walla, Wash., the street railway company, the steam motor line to Milton, was regarded favorably. A company is to be organized to build and operate a road.

Street cars for smokers are to be tried on the Market Street Cable Railway in Philadelphia. The company has recently designed a number of open motor cars 18 ft. long intended for the use of lovers of fresh air and tobacco.

SEALED PROPOSALS.

GRANITE PAVING BLOCKS.

Tenders will be received at the Office of the Board of City Works, City Hall, up to noon on Monday, November 3d next, for supplying the city of Halifax with 16,000 square yards of granite paving blocks 3½ to 4 inches in width, 6 to 6½ inches in depth, 8 to 10 inches in length.

All edges to be sharp and straight, forming right angles at their intersections, both horizontally and vertically. All faces to be straight split or dressed off so as to be free from bunches and depressions. Each and every block to be equal as regards quality, appearance and finish to sample block, which must be submitted with each tender, and must also, in every respect, be satisfactory to the City Engineer.

Proposals to state the price per square yard (the blocks being closely placed together as laid), delivered on wharf at Halifax or at Board of Works shops. Also—The number of square yards the contractor will deliver monthly from 1st May to 1st November, 1891.

Payment will be made on certificate from the City Engineer to the amount of 80 per cent. of the material delivered and approved, and the balance upon completion of the contract.

Satisfactory security for the due fulfillment of the contract will be required from the successful bidder.

The lowest or any tender will not necessarily be accepted.

By order of Board of City Works,

W. B. McNUTT,
Clerk of Works.

September 19, 1890.

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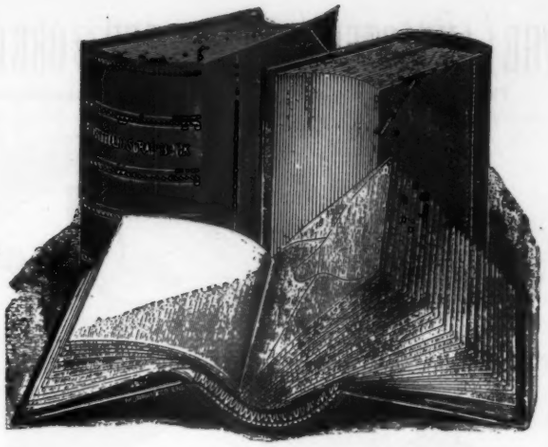

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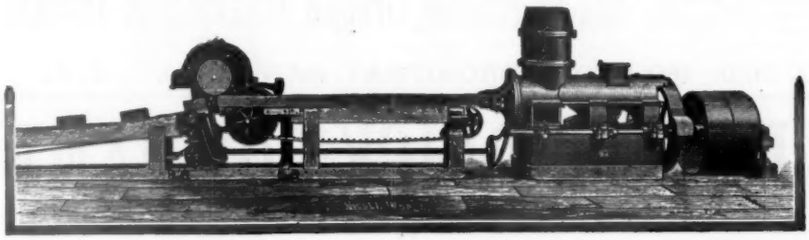

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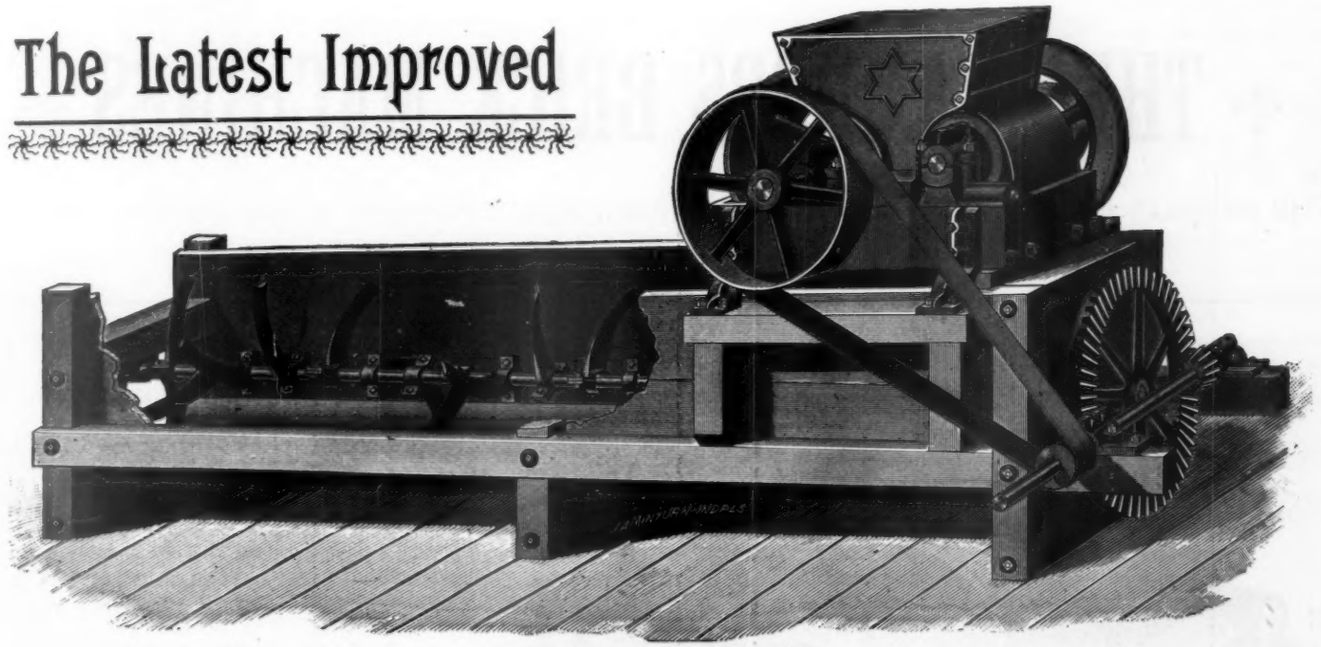

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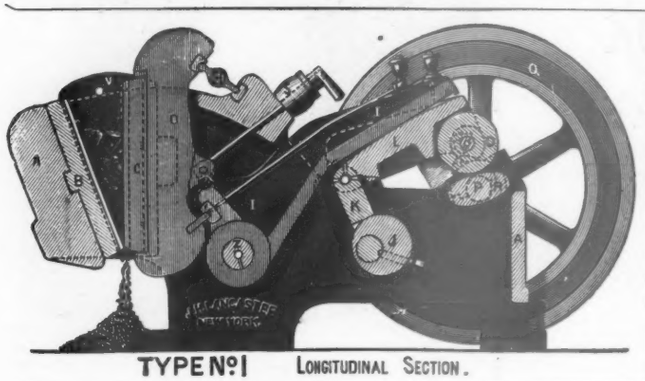

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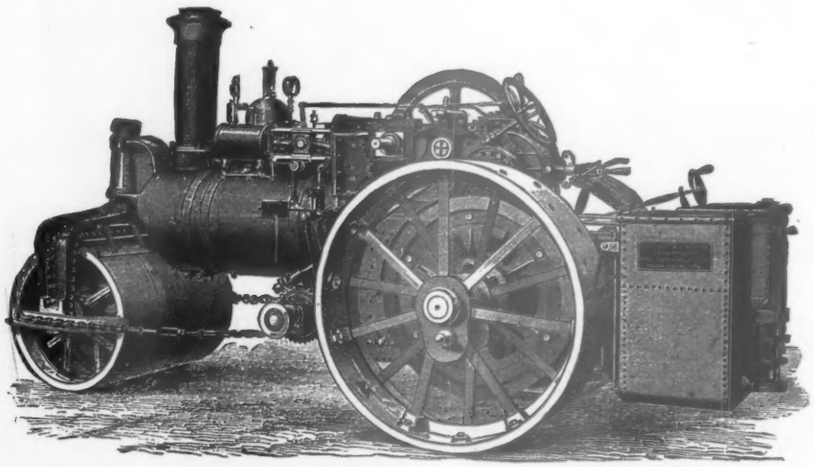

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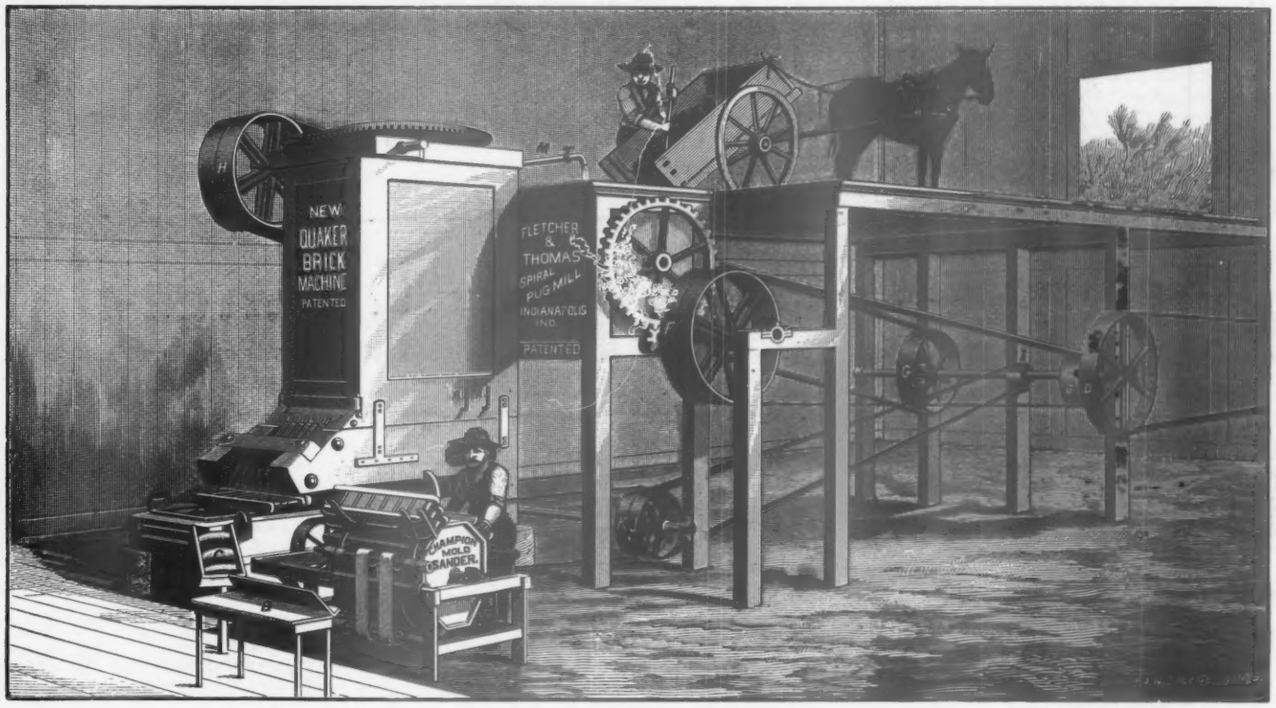

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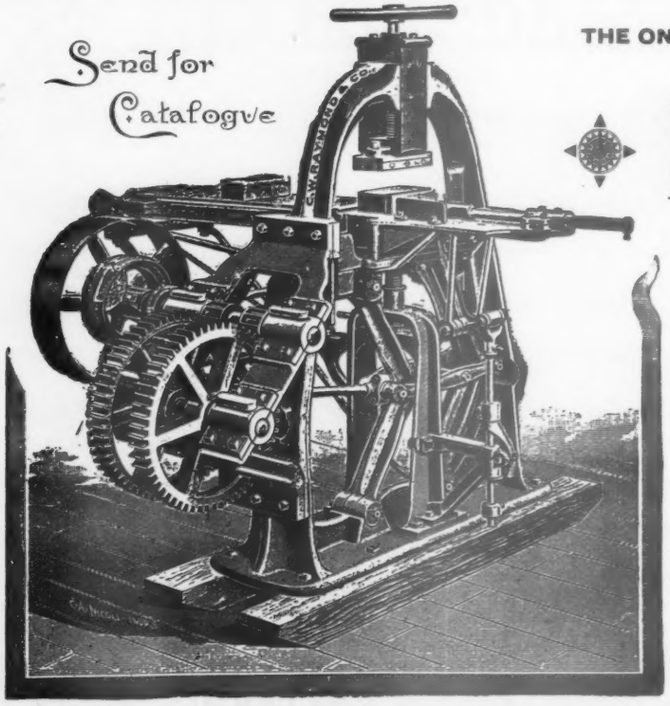

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